Q1: *"My question is why water wells were not considered in the health risk factor. What was considered the 'immediate vicinity of the site?' I have learned the Highland neighborhood relies on household wells for their drinking water."*

A1: There a number of reasons why groundwater wells in Highlands should not be expected to be affected by contaminants from the San Jacinto River Waste Pits (SJRWP) superfund site. The dioxin wastes from the pits bind tightly to sediments, clays, and sands, so they are not free to move significantly with groundwater flow. Contaminants would have to pass down through over 300 feet of overlying clays and alluvial deposits and then migrate a mile north to get down to the level where water wells in the Highlands area are screened (generally around 330-350 ft.). Compacted clays under areas with significant subsidence (as in the vicinity of the SJRWP site) form nearly an impermeable barrier to the downward passage of water. Groundwater flow through the Chicot and Evangeline aquifers is relatively slow – in the range of a few feet per year. Ground water in these aquifers generally flows toward the gulf and consequently away from Highlands which is north of and on the other side of the river from the waste pits. In the vicinity of rivers (such as the San Jacinto), the shallow groundwater from both sides of the river tends to flow toward the river and would not be expected to cross under the river, carrying contaminants to the other side (even if the contaminants were dissolved and could move freely with the groundwater).

The nearest residential neighborhood would be in Channelview, TX, approximately ½ mile west of the site. DSHS does not consider this neighborhood to be in the "immediate vicinity of the site." Highlands, TX, approximately ½ to 1 mile east or northeast of (and across the river from) the site would also not be considered to be in the "immediate vicinity of the site." For this PHA, water wells in either of these communities were not considered to have any significant possibility of dioxin contamination from the SJRWP site. Subsequent EPA sampling of shallow groundwater at a depth of 60 feet directly beneath the surface impoundments did not detect any measurable amounts of dioxins, thus confirming the validity of our initial assessments about groundwater.

Q2: *"I noticed that in the health assessment the issue of the San Jacinto River flooding its banks was not mentioned. I believe that Highlands is in a 10 year flood plain. Since flood waters can contaminate wells, would this not be a problem for homeowners?"*

A2: It is true that parts of Highlands are in the 10-year flood plain. However, during most flooding events, massive amounts of water are flowing in from the entire catchment area of the San Jacinto River. These waters are trying their best to get into the river and from there into the gulf, the area of lowest elevation. When too much water has fallen in Highlands and farther up-stream, the river channel is not big enough to carry the volume, and water "backs up" causing the area to flood. The water is still gradually working its way down-stream (and not really "backing up" or flowing in reverse), it just can't drain out of the area fast enough to keep the water from building up in the flood plain areas. The only times that water may move somewhat in a retrograde direction is during unusually high tide events and, to a far greater extent, during storm surges from hurricanes, such as Hurricane Ike in 2008. During these events, massive amounts of salt

water from the gulf are "piled up" on the east side of the hurricane as a result of the counter-clockwise rotation of the hurricane-force winds. When the gulf waters are piled up in front of a river channel, huge volumes of gulf water flow retrograde up the river causing severe flooding up-stream.

Clearly some of the contaminated sediments from the site may have become suspended in the storm-surge waters. However, it is also clear that there would be massive dilution of these suspended and contaminated sediments into millions (or possibly billions) of gallons of salt water, the vast majority of which made its way back into the gulf as the storm-surge subsided. The minor amounts of residual, highly-diluted, contaminated sediments still would have to percolate down through 350 feet of sand and clay which would act as a filter, effectively removing any significant trace of sediment from the water that eventually winds up in the aquifer where it could be accessed by someone's well. (Remember, dioxins bind tightly to sediments and therefore do not move well horizontally or vertically through a sand and clay aquifer). Consequently, it is just not plausible to imagine significant amounts of sediments being washed out of the surface impoundments at the site and being transported a mile north and across the river to Highlands where they could get down into someone's well at concentrations high enough to be a health hazard. Thus DSHS does feel there is any significant likelihood that well water contamination (with dioxins) would be a problem for homeowners in Highlands. Fecal coliform (and other fecal micro-organism) contamination of wells from nearby flooded sewers, septic systems, and animal wastes are a far more likely health risk during such floods.

Q3: *"In previous community meetings, residents have vocalized concerns of negative health impacts including increased cancer risk from living near the SJRWP."*

A3: These concerns are quite understandable, and this is precisely why DSHS has gone to such great lengths to identify all the potential exposure pathways whereby individuals may be, in fact, exposed to site contaminants. It is important for everyone to understand that proximity to the SJRWP site does not in itself imply exposure to site contaminants. Because of the nature of the contaminants, their low volatility, their high affinity for soil particles, and the high vegetation coverage on the site – leading to low likelihood of wind-blown dust – the airborne route was not considered a significant pathway of exposure for this site. Groundwater was not a significant pathway because shallow groundwater is brackish and non-potable, contaminants are tightly bound to sediment and do not migrate to deeper aquifers or horizontally to strata under neighborhoods in Channelview or Highlands where they might get into someone's well water. Consequently, living near the SJRWP site has no bearing on cancer risks or other negative health impacts, unless the individual (in addition to living near the site) also consistently engages in one of the identified risky behaviors such as regular oral ingestion of site sediments, regular skin contact with site sediments, or regular ingestion of fish or crabs from the river or ship channel.

Q4: *"The residents have also expressed concerns regarding contact with contaminated water via flooding, recreational use of the river as well as eating contaminated fish and crabs."*

A4: As part of the Dioxin TMDL Project, the University of Houston collected over 150 water samples from the San Jacinto River, Houston Ship Channel, and Upper Galveston Bay in 2002-2004. The highest dioxin concentration among these data was 3.09 pg TCDD TEQ/L (1 picogram or pg is one millionth of one millionth of a gram). Even if a person was drinking 2 liters of that water per day for a 70 year lifetime, the possible increased risk for cancer would be only $6.6x10^{-6}$ (far below any level of concern). Periodic swimming or other recreational use of the river would produce far lower levels of exposure than drinking 2 liters of the water per day. Of course fish and crabs tend to accumulate dioxins in their tissues, thus delivering a much higher dose to people who consume them. Fishing advisories have been in effect for these waters for years, recommending that men should eat no more than one 8-ounce meal of catfish or blue crabs from this area per month and that women of child-bearing age and children should not consume any catfish or blue crabs from the San Jacinto River near I-10, the Houston Ship Channel, or the Upper Galveston Bay.

Q5: *"Residents along the San Jacinto River at the community meeting have also expressed concern that dust from the sediment (possibly at low tide or time of drought) where soil that has been contaminated may blow from the site and possible expose residents and/or fishermen and that needs to be more fully explained."*

A5: Prior to the EPA's recent TCRA, the site was covered with thick vegetation, small trees, and heavy undergrowth. Even at the lowest tide (typical diurnal tidal range 1-2 feet) and under drought conditions, the eastern impoundments were covered with muddy sediments (during higher tides they were covered with water) and the western impoundment was boggy and covered with heavy vegetation. The trail along the ridge between the eastern and western impoundments was hard-packed mud with very low likelihood of dust generation even in windy conditions. Consequently, inhalation of blowing dust from the site was not considered to be a significant pathway of exposure either for distant residents or for fishermen at the site. For additional discussion of this issue, see Appendix E, Response 1-6C.

Q6: *"We know that children eat more food, drink more fluids, and breathe more air in proportion to their body weights than do adults, we believe that the Health Assessment should consider the childhood obesity issue and possibly reevaluate the consumption rate for children."*

A6: While it is true that children eat mote food, drink more fluids, and breathe more air in proportion to body weight than do adults, this factor has already been taken into account by the method used by DSHS to calculate the child's fish consumption rate. This rate was calculated as the adult fish consumption rate multiplied by the child's body weight to the $3/4^{th}$ power divided by the adult's body weight to the $3/4^{th}$ power. For example, given an adult weighing 70 kg, eating 8 ounces of fish per day, and a child weighing 35 kg (50% of the adult's weight), the child's fish consumption rate is calculated as 4.76 ounces per day (59% of the adult's fish consumption). Remember too that if a child is 20% overweight and that child eats 20% more fish than the normal-weight child, the exposure dose, in mg/kg body weight, is the same as for the normal-weight child. This occurs because you have multiplied both the numerator and the

denominator of the exposure dose calculation by a factor of 1.2. The SJRWP PHA is already replete with conservative assumptions, and the fish consumption rate for children and adults in the Subsistence Fisherman Scenario is a prime example. While the consumption rates used for this scenario in the PHA are plausible (because they lie somewhere between the 95th and 99th percentile for fish consumption), they are higher than any average fish consumption rate quoted in the EPA's Exposure Factors Handbook. Consequently, we feel that there is no need or justification for an additional, arbitrary, fish-consumption factor for obese children. (How many children like or eat that much fish anyway?) Recalculating the risk numbers, based on an even higher fish consumption rates for children, would not change the conclusions or recommendations of the SJRWP PHA.

Q7: *"PCDDs and PCDFs have very low volatility and are tightly bound to sediment. However, drought and low tide conditions create inviting fishing locations in the riverbed which may expose fishermen to sediment-bound contamination."*

A7: Since the site is in a tidal area of the river, the riverbed is not really ever exposed (and this is not where the highest dioxin levels were found). Before the EPA's Time Critical Removal Action, water standing over the eastern impoundments, along the western bank of the river, would indeed have receded and exposed more of the muddy sediments covering the pit area during low tides (typical diurnal tidal variation 1-2 feet). However, our basic assumption is that people who visit the site are being exposed to those sediments anyway, so this wouldn't change any of the numbers, conclusions, or recommendations for this PHA.

Q8: *"Wind gusts may also carry sediment bound contaminants to nearby residential properties. We recommend that the Health Assessment consider these issues more fully."*

A8: This concern is very similar to **Q5**, and the response is given in **A5** above.

Q9: *"In cases such as this, cancer cluster analysis or a questionnaire regarding health disparities can be very helpful. A request for a cancer cluster analysis was made by residents at the last community meeting. Information gained as a result of such an analysis can provide relevant information to the residents and possibly abate concerns."*

A9: This issue is addressed in the section titled "Health Outcome Data" above. It is also addressed in much greater detail in Appendix E, Response 1-8B.

Commenter #1: Harris County Pollution Control Department

Comment 1-3B A Residential Health Survey Was Not Done, Pages 17-18.

> Also, the Health Assessment did not conduct a residential health "survey" as a means to gather health information from area residents.

Response 1-3B:

> Residential health surveys in the surrounding neighborhoods or other health outcome data evaluations were not done at this site because the airborne and water-borne routes were not considered significant pathways that may have exposed a larger, geographically circumscribed population. At this particular site, only those individuals who visit the site and have skin contact with site contaminants or who eat fish caught from the San Jacinto River, Houston Ship Channel, or Upper Galveston Bay are at potential risk from dioxin exposures. A residential health survey of hundreds of people living in the surrounding neighborhoods (most of whom do not have any quantifiable exposures to site contaminants) would produce results that were scientifically uninterpretable and potentially mislead the public. The only possibility of obtaining a meaningful result depends on being able to differentiate between truly exposed and non-exposed individuals and having sufficient numbers in the exposed category to produce statistically quantifiable results. Since truly exposed individuals, routinely visiting the site and/or eating fish or crabs from the various Houston waterways, may live anywhere in the Houston area, the exposed population is undefinable. Similarly, detailed assessments of the birth defects database or cancer registry database would yield ambiguous results because exposed individuals could not be differentiated from unexposed individuals in these registries. Also, the proximity of the Houston Ship Channel (and all the VOC air contaminants associated with activities in the Port of Houston) would be a significant confounding factor for any studies of the site and its surrounding neighborhoods.

Comment 1-3C Residents Concerned About Cancer Risks, Pages 17-18.

> In previous community meetings, residents have vocalized concerns of negative health impacts including increased cancer risk from living near the SJRWP.

Response 1-3C:

> These concerns are quite understandable, and this is precisely why DSHS has gone to such great lengths to identify all the potential exposure pathways whereby individuals may be, in fact, exposed to site contaminants. It is important for everyone to understand that proximity to the SJRWP site does not imply exposure to site contaminants. Consequently, living near the SJRWP site has no bearing on cancer risks or other negative health impacts, unless the individual (in addition to living near the site) also consistently engages in one of the identified risky behaviors.

A number of factors combine to virtually eliminate the significant possibility of exposures to site contaminants by neighborhood residents who do not frequent the site:

1. First of all, dioxins are relatively non-volatile, solids, which means they do not readily sublimate (become vaporized) into the air where they could be easily transported to nearby residents.
2. While dioxins having only one, two, or three chlorine atoms attached to the rings do have a slight volatility, these mono, di, and trichlorodibenzodioxins are not considered to have any cancer-causing or other toxic potential.
3. The dioxins with four, five, six, seven, or eight chlorine atoms are the only dioxins with cancer-causing potential, and they are all virtually non-volatile.
4. Consequently, dioxin vapors with cancer-causing potential are not a significant possibility at the SJRWP site or, for that matter, for any other dioxin site.
5. Even in the driest periods of the hot summers, pit A, on the west side of the site, was swampy, and there was heavy vegetation covering and surrounding this pit. Pits B and C on the east side of the site have been under water for at least 10 years due to subsidence of the entire area.
6. The highest concentrations of dioxins were found primarily in the pits, as opposed to the soil berms surrounding the pits.
7. Consequently, there has been no possibility of blowing dust from the more heavily contaminated pit areas.
8. The only part of the site not covered by either water or heavy vegetation was the foot path trail along the soil berm between pit A and pits B and C. In most places, the trail consisted of compacted, but still moist, clay which would not have been conducive to the generation of dioxin-contaminated dust that could possibly be blown off-site during high winds.
9. Consequently, significant exposures of nearby residents to wind-blown, dioxin-contaminated dust are not a possibility at the SJRWP site, and the inhalation pathway is totally ruled out at this site.
10. Dioxins have a high affinity for soil particles, and consequently, they do not migrate significantly in groundwater. The sandy sediments of the shallow aquifers in the area act as a filter trapping individual soil particles (and any attached dioxin molecules) effectively preventing their migration either laterally or down to deeper aquifers that might be used as a drinking water source by people in the general vicinity.
11. Consequently, the possibility of significant exposure to dioxins from the site through consumption of water from private wells or other groundwater sources in the area is extremely remote.
12. The surface water in this part of the San Jacinto River is brackish, and no one is likely to drink significant amounts of river or Houston Ship Channel water.
13. The Dioxin TMDL Study measured surface water dioxin levels at hundreds of locations throughout the San Jacinto River/Houston Ship Channel/Upper Galveston Bay waterway. Not surprisingly, the highest concentration found

was from the SJR under the I-10 Bridge (immediately down-stream of the site). Even if people drank 2 liters of this water per day for a lifetime, the possible cancer risks would be only 6.6×10^{-6} which would put it in the "No Apparent Public Hazard" category.

14. Consequently, there is no significant possibility of excess dioxin exposure through consumption of surface water in the area.
15. Since exposure to dioxins through skin contact with dioxin-contaminated river waters (as in the occasional swimmers or waders in the San Jacinto River) would be insignificant compared with some hypothetical person who drank 2 liters of river water per day, the possible cancer risk would be far less than 6.6×10^{-6}.
16. Consequently, there is no significant possibility of excess dioxin exposure through skin contact with surface water by recreational swimmers or waders in the area.

After examining all of the scientific evidence outlined above, DSHS can conclude with great confidence that merely living in the vicinity of the SJRWP does not convey any quantifiable risks. As noted in the PHA, the only significant risky behaviors would be daily (or several times weekly) visits to the site, involving direct skin contact with (or ingestion of) contaminated sediments from the pits or catching and eating fish from the San Jacinto River near the I-10 bridge or other nearby waterways.

Comment 1-3D Residents Concerned Re Flooding, Fish, & Crabs, Pages 17-18.

The residents have also expressed concerns regarding contact with contaminated water via flooding, recreational use of the river as well as eating contaminated fish and crabs.

Response 1-3D:

The relatively minute quantities of contaminated sediments, diluted in millions (maybe billions?) of gallons of flood water, might result in a brief, minor, one-time exposure for people in contact with flood water. However, since risks from chemical exposures are related to the product of (magnitude of exposure) × (duration of exposure) and both the magnitude and the duration are vanishingly small, the possible increased risk for flood victims would be virtually nil.

Likewise, as explained in Response 1-3C above, recreational contact with water from the SJR also does not constitute any measurable increased risk from dioxin skin-contact exposure. The highest dioxin water concentration (3.09 pg/L) reported in the Dioxin TMDL Project data was collected from the SJR below the I-10 bridge. Even if water with that concentration of dioxin was used as a drinking water source and people consumed 2 liters per day for their entire lifetime, the increased cancer risk would be approximately 6.6×10^{-6}. Skin contact with dioxin-contaminated surface water would be a far less efficient

pathway of exposure than drinking 2 liters of dioxin-contaminated water per day. Consequently, dioxin in surface water near the site does not appear to be a significant health issue.

The consumption of fish and crab caught near the SJRWP site was thoroughly addressed in this PHA, and a fish-consumption advisory has been in effect for years for the waterways in the vicinity of the SJRWP site. The fish consumption advisory states that adults should eat no more than one meal (8-ounces of fish) per month and women of child-bearing age and children should eat no fish from the affected waters. However, as there are multiple foci of lower level dioxin-contaminated sediments at many locations in the San Jacinto River/Houston Ship Channel/Upper Galveston Bay waterways, unrelated to the SJRWP site, it is not anticipated that the dioxins-in-fish problem or the fish-consumption advisories will entirely go away after the SJRWP has been cleaned up.

Comment 1-3E Residents Concerned Re Dredging, Pages 17-18.

These other concerns and methods should have been considered especially since the data relied upon is not current and, as previously stated, river sediments may have been redistributed by natural occurrences and dredging operations.

Response 1-3E:

Currency of the data evaluated in the SJRWP PHA is not an issue. In evaluating site contaminants, exposure pathways, and potential theoretical risks, DSHS used existing data and conditions at the site at the time it was added to the National Priorities List. The intent was to provide scientific evidence why the site should be cleaned up and what the possible risks might be if the site was not cleaned up. Data collected by the EPA as part of the time-critical removal action or the remedial investigation and feasibility study (RI/FS) are outside the scope and purpose of the PHA. The data evaluated is sufficient to say that the site is contaminated with unacceptable levels of dioxins, it needs to be cleaned up, and the EPA is appropriately addressing the issue.

Activities at the site over the last 8 or 10 months have focused first on preventing any further land access to the site by the public by fencing the entire area. Second, they have worked intensively on placing a physical barrier on top of all the contaminated sediments in the surface impoundments so that there will be no redistribution of the highly contaminated sediments by natural occurrences or by dredging operations. These activities have eliminated two of the three potential exposure pathways, thereby greatly reducing the possibilities for exposure. Consequently, use of more “current” data and conditions at the site would produce significantly lower risk estimates, which might give the mistaken impression that nothing further needs to be done.

Comment 1-6B Drought & Low Tide May Affect Exposures, Page 27.

> The Comments and Pathway Status column continues by stating that the PCDDs and PCDFs have very low volatility and are tightly bound to sediment. However, drought and low tide conditions create inviting fishing locations in the riverbed which may expose fishermen to sediment-bound contamination.

Response 1-6B:

> Since the SJRWP site and surrounding area has subsided over the years, its elevation with respect to sea level is gradually decreasing. Because of the overall subsidence of the area, less and less of the riverbed are actually being exposed. Since tides generally come in and go out twice a day, there is insufficient time between low tide and high tide for there to be any significant drying of tidally exposed sediments. However, it is indeed true that fishermen visiting and fishing at the site may be exposed dioxin-contaminated sediments. That is one of the major points made and thoroughly evaluated in the SJRWP PHA document, as justification for why the site should be cleaned up.

Comment 1-6C Airborne Exposures Not Adequately Discussed, Page 27.

> Wind gusts may also carry sediment bound contaminants to nearby residential properties. We recommend that the Health Assessment consider these issues more fully.

Response 1-6C:

> As previously explained in Response 1-3C above, the site is heavily covered with vegetation, and even under the recent drought conditions, the surface impoundments were either marshy and damp (pit A) or submerged under water (pits B & C), and the likelihood of contaminated wind-blown dust coming from the surface impoundments is virtually nil. With no data on ambient air levels of dioxins and no expectation that airborne exposures would be occurring, we feel that we have already adequately addressed the possibility of airborne exposures and found it not to be a viable concern.
>
> With that said, if we were to make an assumption that sediment from the impoundments, with an average of 15,594 pg TCDD TEQ/g sediment were somehow being dried out and becoming airborne at 65 µg sediment-dust per cubic meter of air (the EPA's current 24-hour NAAQS primary standard for PM 2.5 particulates in air), and this dioxin-contaminated dust-laden air was in constant suspension in the neighborhoods near the site, the air would contain $65 \times 15{,}594 \div 1{,}000{,}000 = 1.01$ pg TCDD TEQ/m^3. The possible lifetime risk from such an exposure for a 70 kg person inhaling 20 m^3 of this air per day for a 70-year lifetime (assuming 100% absorption) would be 4.33×10^{-5}. If the exposure duration is changed to a more realistic 30 years and the absorption is set to a more

realistic 50%, the possible risk would be 9.28×10^{-6}. Both of these risk estimates would be interpreted as "No Apparent Public Health Hazard" and would amount to less than 6% of the possible risks from either oral or dermal exposures for the Subsistence Fisherman. Consequently, even under the worst imaginable (and entire hypothetical) conditions, airborne dioxin-laden dust would not be a significant problem at the SJRWP site.

Comment 1-8A Exposure Sources from Living Near Site, Page 29.

The Health Assessment indicated that some exposures occur as a result of living "near" a hazardous waste site containing dioxin.

Response 1-8A:

Toward the bottom of page 27, in the discussion of possible exposures and pathways, we do mention that "living near a hazardous waste site containing dioxins" may be a possible pathway for a person to get additional exposures to dioxins. However, each waste site must be evaluated, based on the unique conditions at that site, and this route may or may not provide a significant contribution to total exposures at any particular site. For example, if this site were in Odessa and the pits were dusty and dry and fine powdery sediments were easily picked up by every little breeze that came by, then airborne dust would have been one of the pathways that would have been fully evaluated and addressed in the PHA. In Response 1-6C above, we quantitatively explore the inhalation pathway under worst-case conditions similar to the hypothetical Odessa scenario above. Even under the worst imaginable (and entire hypothetical) conditions, airborne dioxin-laden dust would not be a significant problem at the SJRWP site.

One of the subtle points is that living in proximity to a waste site does not necessarily imply exposure to site contaminants. This is precisely why DSHS has gone to such great lengths to identify all the potential exposure pathways whereby individuals may, in fact, become exposed to site contaminants. As noted in the PHA, the only significant risky behaviors for this site would be daily (or at least several times weekly) visits to the site, involving direct skin contact with (or ingestion of) contaminated sediments from the pits or catching and eating fish from the San Jacinto River near the I-10 Bridge or other nearby waterways. Because of this, living near the SJRWP site has no direct bearing on cancer risks or other negative health impacts, unless the individual (in addition to living near the site) also consistently engages in one or more of the identified risky behaviors. On the other hand, living several miles away from the site does not necessarily imply that the person is not exposed to and at risk from site contaminants. In both cases, risks depend entirely on the presence or absence of risky behaviors (i.e., oral and dermal contact with site sediments and SJR fish consumption).

Comment 1-8B A Cancer Cluster Analysis May Be Helpful, Page 29.

The Health Assessment states:

> *Cancer health effects that are suspected (but not yet confirmed to be associated with dioxin exposures) include all cancers combined, rectal cancer, pleural cancer, lymphohemopoietic cancer, leukemia, respiratory cancers, prostate cancer, and multiple myeloma (a malignant tumor of plasma cells affecting the bone marrow. HA, Page 29.*

This is where cancer cluster analysis or a questionnaire regarding health disparities can be very helpful. A request for a cancer cluster analysis was made by residents at the last community meeting. Information gained as a result of such an analysis can provide relevant information to the residents and possibly abate concerns.

Response 1-8B:

Unfortunately, cancer cluster analyses are not quite the panacea that many people perceive them to be. A "cancer cluster analysis" may be somewhat of a misnomer in cases where a cluster has not been identified. Nevertheless, such analyses can only tell us whether the cancer incidence rates or cancer mortality rates in one area are significantly higher than, comparable to, or significantly lower than the rates in some other area. It cannot tell us what, if anything (outside of pure random chance), may have caused difference in the rates for the two areas.

Another limitation of "cancer cluster analysis" for small population areas in proximity to a particular site (where the airborne route is the major exposure pathway) is that the number of new cancer cases or cancer deaths in such areas is small, and the numbers can and do vary drastically from one year to the next by sheer chance. This leads to considerable uncertainty in the true underlying cancer incidence or mortality rates for the area. Expanding the area to include a much larger and more stable population size invariably dilutes any truly exposed population with thousands of people who are not exposed, making it harder to identify slightly increased rates in the exposed.

When cancer rates are significantly elevated in the study area, it is tempting to conclude that they are elevated because of, for example, the waste site situated in the study area. However, when the converse is found, few people are willing to argue that the waste site in the study area is providing a protective effect for the study population. Elevated cancer rates in a study area are not sufficient evidence to prove (or even strongly suggest) that a waste site in the area is the cause of the problem. For a good scientific argument, one must demonstrate an unbroken chain of evidence that shows that:

1. the cancer rates in the study area are significantly elevated when compared to an appropriate comparison population of similar racial, ethnic, cultural, and socioeconomic characteristics,
2. (Here, a "significantly elevated rate" implies a standardized incidence or mortality ratio of 5.0 or higher and 95% confidence interval that does not include 1.0),
3. the two populations are similar with respect to access to medical care, dietary patterns, smoking habits, alcohol consumption, and other leading risk factors for cancer,
4. the contaminants at the site are carcinogenic,
5. the cancer(s) being observed are to be expected based on the specific carcinogens and completed pathways of exposure identified for the site,
6. the exposure to site carcinogens has been occurring over a long period of time (at least as long as the typical latency period for the specific cancer, which may be 20-30 years),
7. the combined exposures at the site have delivered sufficient doses to individual cancer victims for this to be a plausible explanation for the cancers.

If any link in this chain of evidence is missing or unknown, then the conclusions become more speculative in nature; if a link is broken or disproven, it may be necessary to conclude that the increased cancer rates in the study area are the result of a chance occurrence and not of a common exposure.

Health disparity data or residential health surveys for the surrounding neighborhoods were not collected or evaluated for the SJRWP site because the airborne and water-borne routes were not considered significant pathways that may have exposed a larger, geographically circumscribed population. At this particular site, only those individuals who visit the site and have skin contact with site contaminants or who eat fish caught from the San Jacinto River, Houston Ship Channel, or Upper Galveston Bay are at potential risk from dioxin exposures. A residential health survey of hundreds of people living in the surrounding neighborhoods (most of whom do not have any quantifiable exposures to site contaminants) would produce uninterpretable results that, unfortunately, would be highly prone to misinterpretation.

The only possibility of obtaining a meaningful result depends on being able to differentiate between truly exposed and non-exposed individuals and having sufficient numbers in the exposed category to produce statistically quantifiable results. Since truly exposed individuals, routinely visiting the site and/or eating fish or crabs from the various Houston waterways, may live anywhere in the Houston area, the exposed population is nearly impossible to identify. Similarly, detailed assessments of the birth defects database or cancer registry database could be done and might be of some interest to area residents but they could easily be misinterpreted. These analyses would yield ambiguous results because

exposed individuals could not be differentiated from unexposed individuals in these registries. Also, the proximity of the Houston Ship Channel (and all the VOC air contaminants associated with activities in the Port of Houston) would be a significant confounding factor for any studies of the site and its surrounding neighborhoods.

Comment 1-10 Follow-up of Residents in Surrounding Neighborhoods, Page 41.

For actions planned, the HA states that:

> *Follow-up of individuals living in the surrounding neighborhoods was not recommended because the airborne and water-borne routes were not considered significant pathways that may have exposed a larger, geographically circumscribed population. HA at Page 41.*

Based on concerns of the community raised at the April, 2011 community meeting, our recommendations to take into consideration additional sampling data, and the Health Assessment's evaluation that there are unknowns in regards to ambient air and surface water (*see* Table 2, page 67), it is recommended that the Health Assessment consider conducting a follow-up of residents living in the surrounding neighborhoods to make the assessment process as inclusive as possible.

Response 1-10:

If the EPA has collected recent up-wind and down-wind ambient air samples, surface water samples, and/or ground water samples, and if there is sufficient interest, these data potentially could be evaluated under a separate Health Consultation. However, since the site conditions have changed drastically since the EPA's Emergency Action began, these new air data (whatever they might show) could not be assumed to be representative of historical air exposures. Unfortunately, historical data gaps cannot be filled by collecting new data.

Although surface water data from the Dioxin TMDL Project were not evaluated and reported in the SJRWP PHA, we did look at the highest dioxin level found in surface water in the San Jacinto River/Houston Ship Channel/Upper Galveston Bay system (collected from the SJR below the I-10 Bridge). If water with that concentration of dioxin was used as a drinking water source and people consumed 2 liters per day for their entire lifetime, the increased cancer risk would be approximately 6.6×10^{-6}. This would be interpreted as no apparent increased lifetime risk for cancer. However, since the SJR near the I-10 Bridge is not a consistent drinking water source for anyone we know of, these numbers are purely hypothetical as well as inconsequential.

Since the airborne and surface water routes of exposure have been eliminated as significant possibilities for the site, the absence of data in these media has no impact on and in no way weakens the overall conclusions of the PHA.